

## **Guest Editorial: New Trends in the Planning of Distribution Network with High Penetration of Renewables and Flexible Loads**

### **Introduction**

We appreciate very much the support from the *IET Generation, Transmission & Distribution* editorial board for this Special Issue on 'New Trends in the Planning of Distribution Network with High Penetration of Renewables and Flexible Loads'. In this final version for publication, 29 papers have been selected for this Special Issue. Six papers are related to the grid planning consideration of electric vehicles (EVs) and charging stations, eight papers on the planning of renewables and energy storages, six papers on the investigation of topology of distribution network, and nine papers on the forecasting method and other discussions on the planning and operation of distribution network.

### **Grid Consideration of Electric Vehicles**

To identify the charging behavior of EVs, Paper 1 by Hong *et al* develops a set of EV charging load profiles by an improved K-prototypes method. Paper 2 by Gjelaj *et al* presents a planning method to integrate DC fast-charging stations into power grid, Paper 3 by Jiang *et al* utilizes the multi-agent systems (MAS) and evidential reasoning (ER) approach to optimize the location of charging stations, and Paper 4 by Sun *et al* introduces a hierarchical optimal planning approach for siting and sizing of fast charging stations. Based on fuzzy Bayesian learning, Paper 5 by Zhang *et al* proposes a negotiation strategy between EV aggregator and power grid, for the participation of EVs in vehicle-to-grid (V2G) activities. Paper 6 by Su *et al* considers drivers' behavior and proposes reactive power compensation strategy using EVs for voltage support of power grid.

### **Planning of Renewable Generations**

The flexibility at the demand side has an impact on the planning of renewable generations and power grid. Paper 7 by Dang *et al* proposes a distributed generation (DG) planning model coordinating demand flexibility to promote the integration of renewables, and Paper 8 by Ehsan *et al* presents a scenario-based robust DG investment planning model that can consider the uncertainties of renewables and load demand. Paper 9 by Zhang *et al* presents a scheduling method using the time-of-use pricing scheme for wind-battery energy storage hybrid systems, and in Paper 10 by Dong *et al*, the stochastic extreme events are considered for the sizing of battery and backup generators. Paper 11 by Zhang *et al* presents a life cycle planning method for battery energy system in wind-solar-diesel microgrid. Paper 12 by Lakshmi *et al* presents an allocation planning method for voltage source converters (VSCs) to improve the photovoltaic (PV) hosting capacity and energy efficiency of distribution network, Paper 13 by Huang *et al* proposes a graphic processing unit (GPU) based parallel volt/var optimization for distribution network with DG, and Paper 14 by Wu *et al* proposes a decomposition method for coordinated planning of DG and distribution network.

### **Topology of Distribution Network**

In recent years, some new topologies are identified in distribution network. Paper 15 by Xiao *et al* introduces flexible distribution network, and presents its definition, configuration, operation and a pilot project. Paper 16 by Zhang *et al* introduces an optimal configuration of hybrid AC/DC

urban distribution networks for the high penetration of renewable energy, and Paper 17 by Guo *et al* presents a graph theory based topology design and energy routing control for hybrid AC/DC network. Paper 18 by Teshome *et al* introduces an enhanced mixed integer linear programming model and Paper 19 by Ganesh *et al* presents a meta-heuristic technique for reconfiguration of distribution network with DG, respectively. In Paper 20 by Gouin *et al*, the stochastic integration of demand response and reconfiguration is investigated for the expansion planning of distribution network.

### **Forecasting and Other Considerations for Network Planning**

To investigate the correlation between wind and PV power, Paper 21 by Wu *et al* presents a PV-wind joint power probability model based on multiple temporal and spatial scale. Paper 22 by Iannarelli *et al* investigates the economic impact of investments in weather forecasts for distribution system operators according to the Italian case. Paper 23 by Zang *et al* introduces a hybrid method based on deep convolutional neural network for short-term PV power forecasting. Paper 24 by Jia *et al* analyzes the power fluctuation characteristic of wind power and introduces power smoothing strategies. Paper 25 by Li *et al* develops a method for division of urban load power supply district, which integrates the open source data into the planning of distribution network. Paper 26 by Liu *et al* proposes a robust load frequency control strategy based on equivalent input disturbance for power grid with wind farms. Paper 27 by Valsamas *et al* presents a comparative study of active anti-islanding schemes suitable for module integrated converters at low-voltage distribution network. In Paper 28 by Shuai *et al*, a fast restraining method for inrush voltage and current is presented for droop controlled inverter during grid fault clearance in distribution network. Paper 29 by Feng *et al* presents an expansion planning model for distribution network considering the deployment of smart management technologies.

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